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Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/735
ITALY
February 1964
Submitted in:
ENGLISH and FRENCH

Confidential until official release during Conference

Abstract

IRRADIATION EXPERIMENTS ON URANIUM-RICH ALLOYS

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Collaboration between C.N.E.N., A.N. and N.P.P.C. has led to a large-scale irradiation experiment, conducted with the aim of increasing knowledge of irradiation damage in fuels and subsequently developing irradiation stable alloys. The first part, described in this paper, compares the behaviour of heat-treated adjusted uranium with some molybdenum alloys at two different temperatures, with and without thermal cycling. Special emphasis was placed on the unusual features of exact simulation of the thermal history of each in-pile specimen.

Finally, the authors report the results obtained so far, as for instance grain size effect in adjusted uranium, effect of thermal cycling together, re-crystallinization and metallographic changes in the alloys due to thermal and irradiation effects.

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/736
ITALY
February 1964
Submitted in:
ENGLISH and FRENCH

Confidential until official release during Conference

Abstract

CHEMICAL AND RADIOCHEMICAL ASPECTS OF ITALIAN NUCLEAR POWER PLANTS

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The paper reviews the chemical and radiochemical aspects of the three Italian nuclear power plants.

(a) Garigliano plant (SENN)

The paper discusses particular technical characteristics, such as the use of Monel in the primary circuit (steam generators), which render the data collected on radioactive crud in this plant particularly interesting. Furthermore, the special start-up procedures adopted have allowed the primary circuit crud to be studied, for the first time in a BWR station, under two different operating conditions, to wit,

- without the crud originating in the feedwater heaters;
- with the crud from the feedwater heaters.

Chemical and radiochemical data obtained during start-up and initial operation on core integrity, steam drum decontamination factors, stack release activity, fission products in the primary water and stack release, primary water and feedwater chemistry are also given. These data are supplemented with information on the operation of reactor clean-up, condensate demineralizer, radwaste and defective fuel detection systems.

(b) Latina plant (SIMEA)

Information on the chemical control of CO_2 during start-up and initial operation is provided, with specific reference to carbon oxide concentrations. The concentration of carbon oxide at equilibrium, as an indication of the degree of corrosion and graphite quality, is compared with data relating to similar plants.

A brief mention is made of the analytical methods which were perfected for the determination of impurities in the CO_2, as well as the performance of the CO_2 generating plant installed at the Latina Station. The generating and storage capacities of the latter plant are analysed in respect of the CO_2 requirements experienced during start-up and initial operation.

Finally, problems arising from the use of a special coating compound during erection for the preservation of the primary circuit metal parts are illustrated.

(c) Trino plant (SELNI)

Chemical problems encountered at this plant are considered, as well as their influence on the choice of chemical treatment for the main cooling system. Details are provided on the chemical treatment system of this station, which is planned to operate under chemical shimming.

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/737
ITALY
February 1964
Submitted in:
ENGLISH and FRENCH

Confidential until official release during Conference

Abstract

GARIGLIANO NUCLEAR POWER PLANT

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The Garigliano station represents one of the first experiences of European utilities in the construction of a large nuclear power plant.

The present report summarized the major problems encountered at the various stages of plant construction and startup, provides comments on the economics and finally illustrates the main results of the tests performed at startup.

The time and place conditions prevailing when the order was placed and in the immediately preceding period greatly influenced the contractual arrangement selected. Today, said conditions are completely changed and it is now possible, on the basis of the acquired experience, to make definite plans for a more up-to-date procedure.

The general analysis of incurred costs indicates that such a new procedure would naturally entail the disappearance or reduction of certain indirect charges, which were automatically accepted in the estimates as a consequence of the selection of the original contract arrangement.

As regards the main results of the plant startup tests, specific reference is made to the primary circuit tests, including diverse recirculating conditions and operating modes, namely single-cycle and dual-cycle.

The fundamental characteristics of the plant were determined on the basis of data collected both under extraordinary conditions and following foreseeable variations of the main parameters.

Thus, the reactor response to load, pressure, cooling flow variations, etc. was analyzed and compared with the data anticipated in the design stage.

The investigation had the twofold purpose of ascertaining that the plant can actually be operated within the expected limits without fear of damaging the fuel elements and other equipment, and of establishing the most advantageous operating conditions.

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/738
FINLAND
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

Radioactive Food Chains in Arctic Regions

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Investigations of bioenvironmental radioactivity in the arctic regions of Scandinavia and Alaska have revealed radionuclide food chains effecting high body burdens of strontium-90 and caesium-137 in animals and man. The most important of these food chains leads from lichens through reindeer to man and causes in reindeer-breeding Lapps and Eskimos up to one-hundred times higher body burdens of caesium-137 than the northern hemisphere average.

For the elucidation of the arctic food chains the Finnish Atomic Energy Commission-sponsored field investigation called "Project Lapland" was started in 1960. In that year a dietary survey of the Finnish Lapps was carried out, which involved about one-third of the Lapp population in Finland. [1] On the basis of the results of that survey a scheme for regular sampling of forage plants and of milk and tissues of reindeer and cow was made. Analyses of strontium-90 and caesium-137 in the biological samples collected from the Finnish Lapland in 1960-61 made it possible to elucidate the essential factors affecting the accumulation of these nuclides in man's diet. [2], [3]

In summer 1961 Dr.L.Lidén of the Radiation Physics Department, University of Lund, developed a semi-portable whole body counter [4] and carried out an investigation in the Jokkmokk area, Swedish Lapland, in which the body burden of caesium-137 in a large group of Swedish Lapps and other inhabitants was determined. [4] One month later a similar investigation including also a detailed study of the dietary sources and levels of caesium-137 was carried out in the Finnish Lapland as a Finnish-Swedish joint study. [5] These studies elucidated the body burdens of caesium-137 and its seasonal variations in the different population groups

in the most important Swedish and Finnish Lapp areas. [5]

In spring 1962 a more elaborate mobile whole body counter, installed in a heavy truck, was developed by the author's laboratory. [6] With this unit a larger survey, including medical and clinical investigations, was carried out in all Finnish Lapp areas in May 1962, followed by more limited surveys in September 1962 and March 1963 [7]

With semi-mobile or mobile units of the same type large field investigations were also carried out by the Hanford Laboratory of the U.S. Atomic Energy Commission in Alaska in summer 1962 [8] and by the Radiation Physics Department of Lund University in the Swedish Lapland in April 1963. [9] In summer 1962 and 1963 our laboratory included in its "Project Lapland" an extensive investigation of hydrospheric food chains, since high concentrations of caesium-137 had been observed in fresh water fish in Lapland. [10]

The results of the Scandinavian investigations will be reviewed and compared with those of the Alaskan "Project Chariot".

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